Federal Aviation Administration

Atlantic Interoperability Initiative to Reduce Emissions

Proposed FY08 Program Plan

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1.0

EXECUTIVE SUMMARY

AIRE, a multinational government, airline and industry partners' approach to limit global aviation's environmental impact.

The air transportation industry has a long and distinguished record of environmental achievement. Reduced energy consumption and engine emissions, in fact, are core aviation business principles. Technological advancement has reduced aircraft fuel consumption and emissions significantly over the last 40 years, a trend that is expected to continue in the future.

The United Nations Intergovernmental Panel on Climate Change (IPCC) attributes approximately 2 – 3% of global carbon emissions to aviation. Although its overall contribution is relatively small, aviation is considered one of the few rapidly growing contributors. Given its expected growth, the task of reducing aviation's environmental impacts will be a challenge.

To meet this challenge, the Administrator of the Federal Aviation Administration (FAA) and the Vice President and Transport Minister of the European Commission (EC) announced in June 2007 the creation of the Atlantic Interoperability Initiative to Reduce Emissions (AIRE) Partnership. AIRE includes a growing membership of government, airline, and industry partners. Working together, the Partnership intends to hasten development and implementation of environmentally friendly, new technologies and operational procedures.

The FAA looks forward to implementing AIRE Partnership objectives and coordinating joint program activities with the EC and its international partners. This proposed FY08 Program Plan describes what the FAA is prepared to offer to the Partnership over the next twelve months and represents an initial step towards achieving the AIRE objectives.

In an effort to identify opportunities for reducing aviation-related environmental impacts, this Plan focuses on aviation domains offering the highest potential near term benefits:

- **Surface** – Traffic congestion on airport surfaces and the associated ground delays and fuel burns present a growing noise and emissions environmental problem for local communities. The AIRE Surface project will focus on stimulating development of trajectory-based surface operations. The goal will be to enhance surface movement operational efficiency, save fuel, reduce engine exhaust emissions and associated noise.

- **Arrivals** – Air traffic congestion around major airports contributes substantially to local noise and emissions. Arriving aircraft today are often radar vectored at low altitudes over or near populated areas, burning fuel at a high rate and creating substantial noise and emissions. The AIRE Arrival project will evaluate the operational feasibility and benefits of Continuous Descent Arrivals (CDA) and Tailored Arrivals (TA) to reduce or eliminate the need for low altitude vectoring or level flight segments, thereby saving fuel and substantially reducing regional noise and emissions.

- **Oceanic** – Today, the flow of traffic on both flexible and fixed routes for transatlantic flights is often suboptimal, due to factors including wind and weather uncertainty, and the need for international coordination among air traffic service providers. The AIRE Program will demonstrate collaborative trajectory optimization in the oceanic environment using a manual optimization process as the first step towards automated Oceanic Trajectory Management.

Environmental Benefits: As a starting point for planned flight trials and demonstrations, teams of FAA and industry subject matter experts (SMEs) were tasked to estimate the potential for environment improvements in the surface, arrival, and oceanic domains. The SMEs estimated potential fuel savings (and corresponding emissions reduction) of 2% for surface operations, 4% for oceanic operations, and 2% for arrivals.

Within the year, initial flight trials and demonstrations are expected to begin validation of the estimated environmental benefits. AIRE progress reports will highlight benefits observed, and offer recommendations for future development and implementation.

Starting as early as December 2007, the FAA anticipates technical interchange meetings with its partners to advance the AIRE Program Plan. There is much to do. Working together, the FAA and the EC can reduce aviation's environmental impacts, and continue the industry's record of environmental achievement.

2.0

BACKGROUND

Increased global air traffic challenges AIRE to hasten implementation, synchronization of environmentally friendly air traffic control systems, technologies and procedures.

Reduced energy consumption and engine emissions are core aviation business principles. Since 1970, the number of airline passengers transported in the United States has tripled while community exposure to significant aircraft noise has decreased almost 95%. Aircraft today are 60% more fuel efficient than the fleet operating 40 years ago. Progressively stringent aircraft noise and emission standards have been established over the past three decades. These include a phase out of Stage 1 and Stage 2 airliners. Airports have voluntarily implemented noise and emission control programs, supported by airport improvement funding and passenger facilitation charges. As of 2007, the U.S. airline industry is moving 12% more passengers and 22% more freight than it did in 2000, with 5% less fuel burned and commensurate emission reductions.

The United Nations IPCC allocates only 2 – 3% of today's global CO2 emissions to aviation.The industry's contribution is depicted in Figure 2.1, where each color coded block represents the percentage of overall greenhouse gas (GHG) emissions generated by each major transport and non-transport sector.

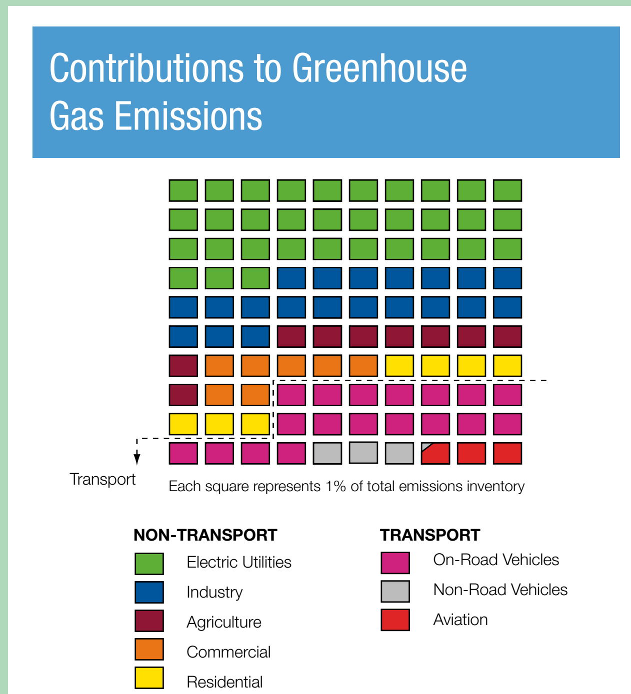


Figure 2.1

While its overall contribution is relatively small, aviation is considered one of the few rapidly-growing contributors. Efforts to minimize the industry's environmental impacts will be complicated by anticipated increases in both domestic and international air transportation operations, as depicted in Figure 2.2.

Environmental impacts resulting from aircraft noise and emissions could emerge as a significant constraint on aviation industry growth. Cooperation to address the industry's environmental challenges could both maximize aviation's collective environmental improvements, and mitigate the potential adverse effects that environmental impacts and society's concerns may impose on industry growth.

The FAA and the EC recognize the advantages of cooperation to achieve common, global aviation priorities. Two current infrastructure initiatives are examples of cooperation to achieve common interests: the Single European Sky ATM Research Program (SESAR) of the European Community, and the FAA's Next Generation Air Transport System (NextGen). The overall objective of SESAR and NextGen is nothing less than a complete transformation of the way airplanes and air traffic are managed.

To further cooperation between the organizations, in July 2006 the FAA and the EC executed a Memorandum of Understanding (MOU) to explore opportunities for:

- Working toward commonality of Air Traffic Management (ATM) systems by implementing interoperable, common technologies in ground and air systems

- Facilitating common, interoperable regulations, standards and procedures

Impact of Traffic Growth on Environmental Challenges

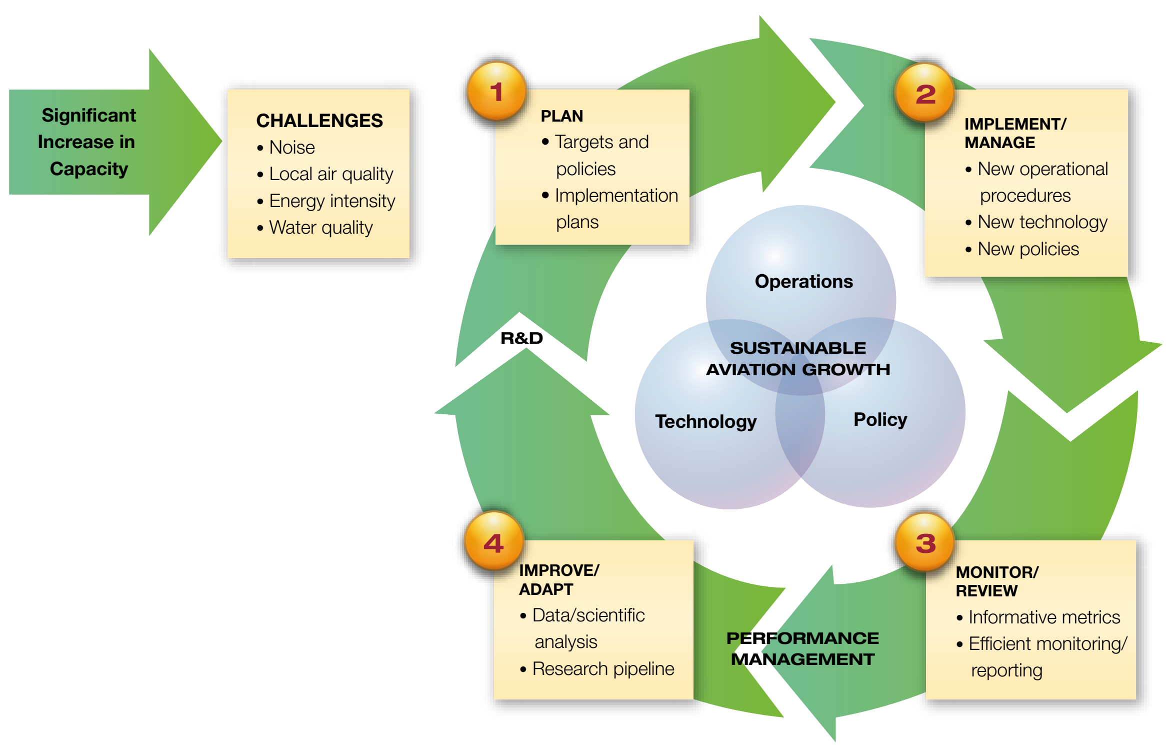


Figure 2.2

- Synchronizing the implementation of new, performance-based systems and technologies, and
- Focusing on safety, security, efficiency and environmental issues related to ATM

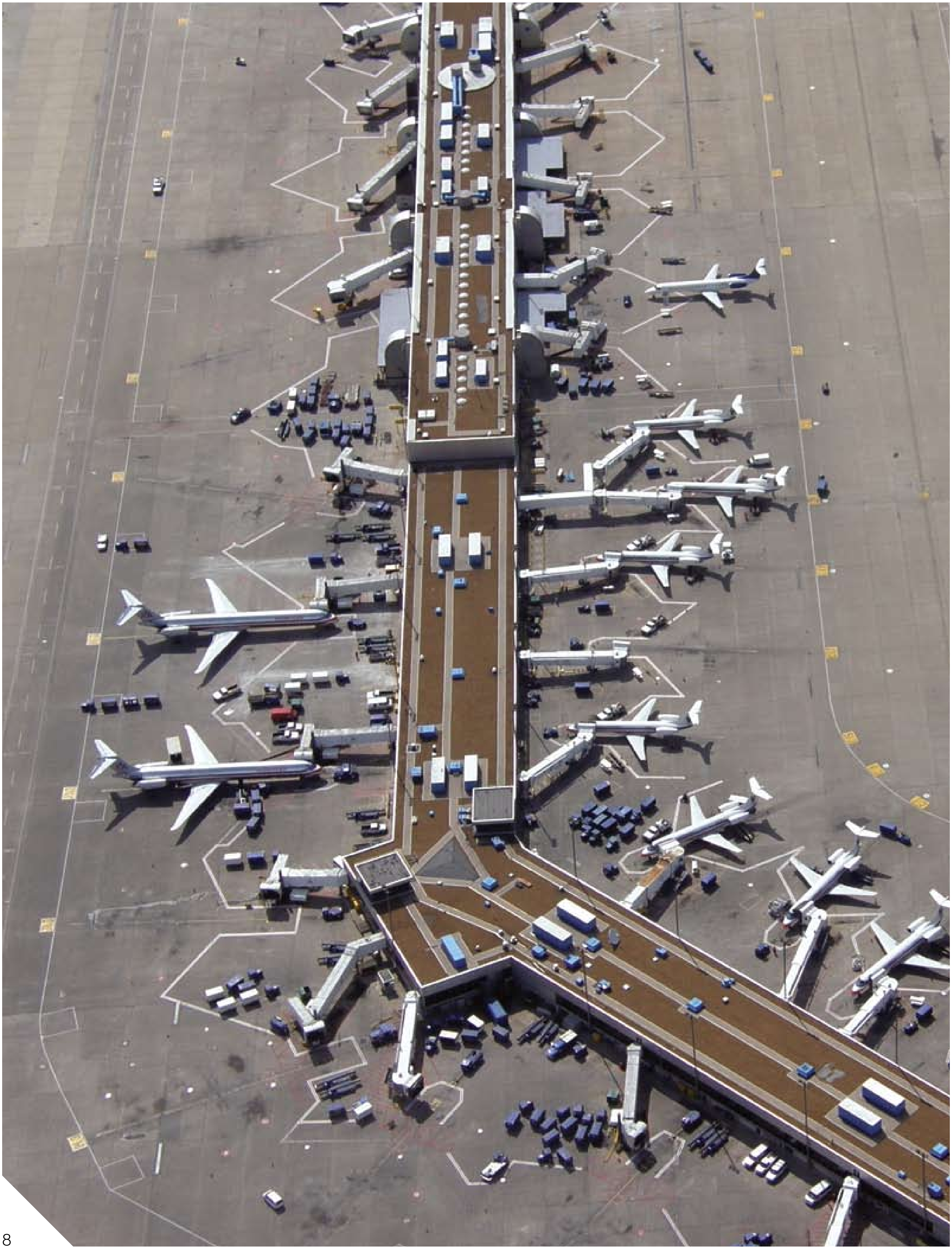
At the Paris Air Show in June 2007, the FAA and the EC announced formation of the Atlantic Interoperability Initiative to Reduce Emissions (AIRE). As the first agreement initiated under the 2006 MOU, the partnership will strive to accelerate implementation of environmentally friendly, new air traffic control technology and procedures (see Figure 2.3). AIRE includes a growing membership of government, airline and industry partners, as shown in Figure 2.4. As discussed at the Air Show, partners anticipate significant environmental benefits to result from formation of the AIRE MOU and plan to verify and validate these benefits with flight trials and demonstrations to begin in twelve months along principal North Atlantic routes.

Figure 2.3 — FAA Administrator and EC Transport Commissioner agree to the formation of the Atlantic Interoperability Initiative to Reduce Emissions (AIRE)

Initial AIRE Partners

- Air France
- Boeing
- Delta
- FedEx
- Airbus
- Continental Airlines
- dgac
- Irish Aviation Authority
- KLM Royal Dutch Airlines
- NAV Portugal, E.P.E.
- United
- virgin atlantic
- Luftfartsverket
- SAS
- ups

Figure 2.4



3.0

OBJECTIVES

Enhance interoperability, improve energy efficiency, reduce engine emissions, lower aircraft noise using environmentally friendly means.

Simply put, the FAA and EC seek enhanced ATM interoperability, improved energy efficiency, reduced engine emissions, and lower aircraft noise. These are the primary AIRE Partnership goals. To take advantage of new technologies and air traffic control procedures offering the most immediate, near-term fuel consumption and emission reduction benefits, the AIRE Partnership will hasten development and implementation of environmentally friendly technologies and procedures for all phases of flight, from gate to gate. AIRE objectives include:

- Promote worldwide interoperability of new technology, procedures and standards.
- Validate projected environmental improvements with flight trials and demonstrations.
- Capitalize on existing technologies on both sides of the Atlantic, and at gateway airports already using advanced technologies and best practices.
- Highlight challenges to implementation, including issues, obstacles, choke points and metrics. Recommend solutions.
- Support the preparation of implementation timelines, the safety case and the business case.
- Provide a systematic approach which combines a set of short, medium, and long-term initiatives to enhance environmental and efficiency performance.

4.0

OPERATIONAL DOMAINS

Select initial domains, identify promising new technologies and procedures; conduct international flight trials to support potential worldwide implementation.

To accomplish its objectives the AIRE Partnership will select candidate new technologies and procedures with promising environmental benefits, focusing initially upon three advanced operational domains, or phases of flight, illustrated in Figure 4.1:

- Surface
- Arrivals
- Oceanic

For the selected new technologies and procedures, AIRE will conduct international flight trials and demonstrations to validate benefits and support worldwide implementation as appropriate. AIRE will focus on international flight trials and demonstrations to facilitate:

- Collaboration with global aviation partners;
- Early identification of NextGen and SESAR interoperability issues;
- Transition towards gate-to-gate planning;
- Participation of the most modern fleet mix; and
- Support from the most advanced air navigation service provider (ANSP) ground automation systems.

4.1 Surface

Airport surface traffic management information requirements include aircraft and surface vehicle identification, position on the airport, movement and intent. Much of this information is derived from controller observation and controller, pilot, and vehicle operator verbal communication. Even at airports with surface surveillance systems, controllers and traffic managers making control decisions must rely on pilots and vehicle operators for position reports. Ground surveillance available to ANSPs is limited. That, and the absence of automated management support tools or a collaborative decision process, contribute to traffic inefficiencies on the airport surface, unnecessary fuel consumption, and undesirable environmental impacts.

The FAA's AIRE Surface project is focused on stimulating development of trajectory-based surface operations in support of the Next Generation Air Transportation System (NextGen). The goal for

AIRE Domain Focus

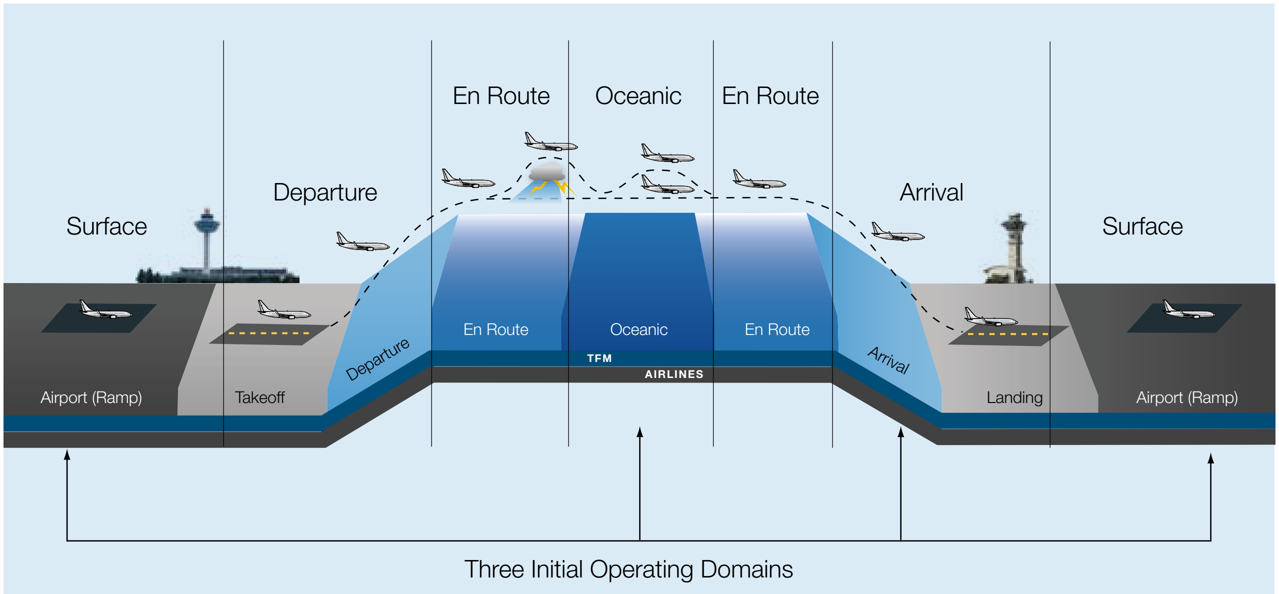


Figure 4.1

surface operations is to minimize ground inefficiencies, thereby saving fuel and reducing aircraft engine emissions.

4.2 Arrivals

The AIRE Partnership is evaluating the operational feasibility and benefits of Continuous Descent Arrivals (CDA) and Tailored Arrival (TA) procedures at Atlanta (ATL) and Miami (MIA) International Airports. Demonstrations are planned.

4.2.1 Continuous Descent Arrival (CDA)

The Continuous Descent Arrival (CDA) is an operating technique in which arriving aircraft descend from an en route altitude with minimum thrust, avoiding level flight to the extent permitted by the safe operation of the aircraft, in compliance with published procedures and air traffic control (ATC) instructions.

The CDA procedure keeps arriving aircraft at cruise altitude as long as possible before beginning the descent to destination. The standard arrival flight path typically includes a series of stepped descents. By comparison, the aircraft executing a CDA is cleared to descend from cruise altitude, or from the top of descent, to final approach using the best-economy power setting, or near flight idle thrust, as shown in Figure 4.2 below. The CDA aircraft continuously descends except during momentary level segments that slow the aircraft without requiring a change to thrust settings (to meet the 250 knot restriction at 10,000 ft altitude). Significant noise, fuel and emissions benefits are anticipated from the CDA procedure.

As an alternative, the CDA may commence at some intermediate altitude, for example, at 10,000 feet. This alternative does not allow the maximum fuel

CDA Procedure CDA compared to Standard Arrival (in blue)

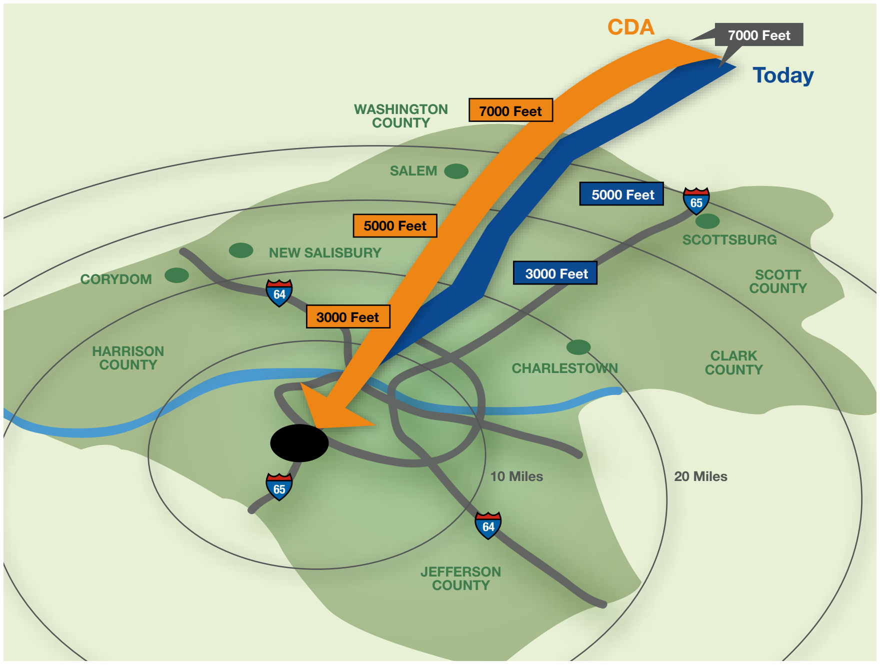


Figure 4.2

benefit, but does provide partial fuel benefit and most of the noise benefit of a cruise altitude CDA.

The CDA may include a Standard Terminal Arrival Route (STAR), which, in turn, may be designed with vertical profiles. STARs are designed to specify standard routes for en route aircraft transitioning to the initial approach fix, with an appropriate transition.

Aircraft performance variations complicate the CDA design process. Optimum descent characteristics vary between aircraft types, and even between different flight management systems (FMS) of similar aircraft types. So while some aircraft may fly an actual idle descent at the optimum FMS-calculated economy speed, other aircraft executing the CDA may fly a non-optimum speed. To overcome these performance variations and to accommodate more aircraft, additional airspace may be reserved for the CDA. Crossing airways and departing aircraft, however, may restrict this flexibility. In reality, the CDA design attempts to optimize a collective solution for all arriving aircraft as well as for crossing and departing aircraft. It is, most likely, a suboptimal solution for the individual aircraft. The CDA enables significant fuel, emissions and noise reductions. Successful CDA implementation requires collaboration between the aircraft operators, airport managers, and of course the ANSP.

4.2.2 Tailored Arrival

If the CDA procedure suboptimizes the individual aircraft arrival solution, the Tailored Arrival (TA) – by way of the integration of all known air traffic, airspace, meteorological, obstacle clearance, and environmental constraints – ideally optimizes the individual aircraft's arrival flight path. The TA trajectory allows an aircraft to meet the required time at the metering fix while performing an idle descent along the optimal lateral path. In addition, airport and runway capacity must be maintained by precise, predictable sequencing, and by coordination of arrival and departure streams. See Figure 4.3.

The Tailored Arrival clearance is a ground-based solution provided to the air traffic controller for meeting a required time over a downstream fix, while simultaneously satisfying all other needs.

The cleared lateral path and other constraints such as crossing altitude and speeds are communicated to the aircraft prior to top-of-descent as part of the arrival clearance. This clearance is entered into the Flight Management Computer (FMC), which subsequently calculates and flies the aircraft's vertical path. Updated meteorological information is also provided to improve flight path efficiency, precision and predictability. The clearance may include speed and altitude constraints. Lateral path may be stretched or shortened to increase control authority for sequencing and coordination.

The resulting arrival is tailored for each aircraft to provide the most efficient flight path in the existing conditions, and will almost always be more efficient than that achieved with traditional voice vectoring techniques.

A Tailored Arrival has the potential to allow aircraft to:

- Fly an optimized descent trajectory for the given conditions while meeting a proposed time at an arrival feeder fix. This leads to reduced fuel-burn, noise, and emissions while maintaining runway capacity.
- Avoid terrain and restricted airspace while taking sequencing flow constraints into account.
- Reduce voice communications during arrival and approach.

Tailored Arrival

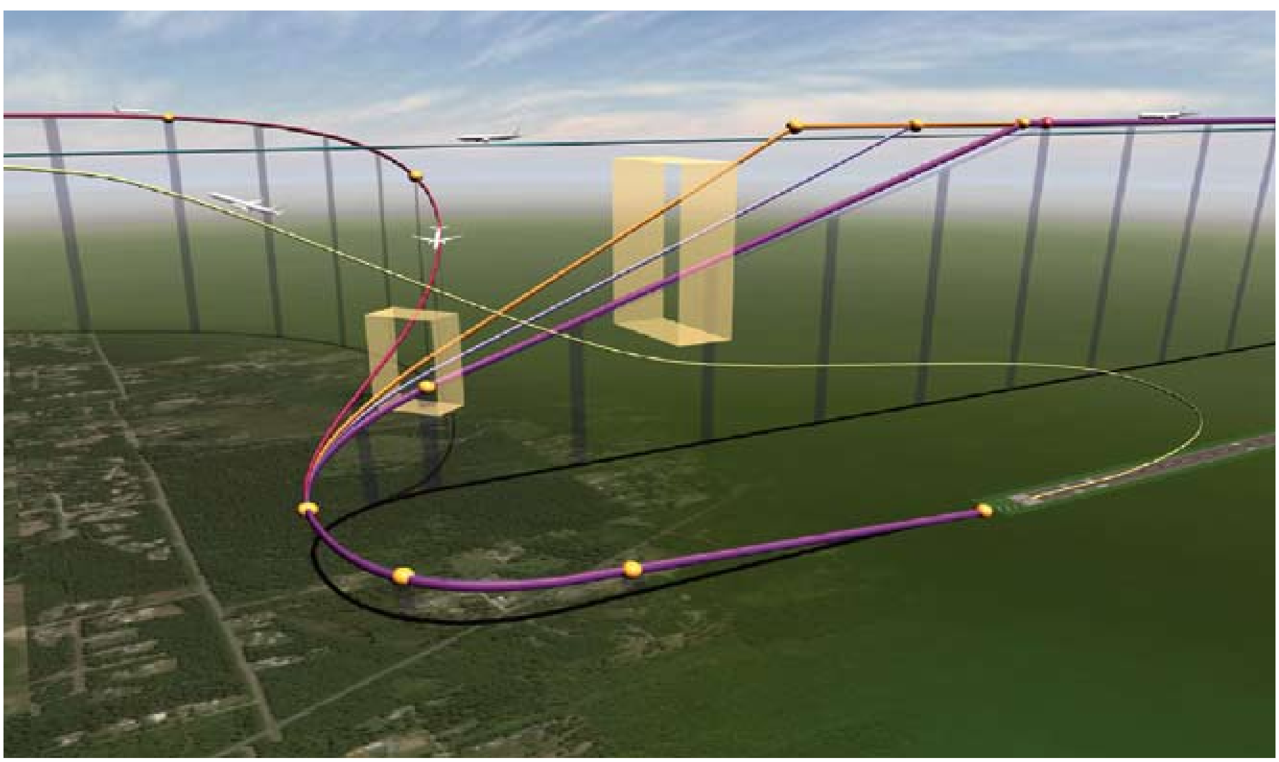


Figure 4.3

- Improve predictability for both the aircraft operator and the ANSP.
- Reduce pilot workload by taking full advantage of aircraft automation.
- Reduce controller workload by reducing the need to devise and provide discrete clearances for each arriving aircraft in order to build the required arrival stream.

4.3 Oceanic

Today, the flow of traffic on both flexible and fixed routes for transatlantic flights is often suboptimal, because either individual flights or sequences of flights on these routes fly along suboptimal, three dimensional trajectories often crossing the entire oceanic leg at one flight level. These result in unused capacity in the oceanic environment, inefficient fuel usage, fewer accepted pilot requests, and airline schedule disruptions.

A four dimensional trajectory (4DT) is a precise description of an aircraft path in space and time. It is the “centerline” of a path plus position uncertainty, using waypoints to describe specific steps along the path. This path is Earth-referenced (i.e., specifying latitude and longitude) and includes altitude designations and the times the trajectory will be executed.

Four dimensional trajectory optimization during trans-oceanic flight may provide major fuel efficiencies, thus reducing aircraft emissions. The concept of 4D Oceanic Trajectory Management (OTM-4D) is a fundamental element of NextGen and is part of an extensive technology development program for oceanic airspace occurring over the next decade.

For the AIRE Program, U.S. and European ANSP and industry partners will demonstrate collaborative en route trajectory optimization in the oceanic environment. Using a manual optimization process with assistance from automated profile optimization tools is the first step towards a functional and automated process for Oceanic Trajectory Management.

Initial AIRE oceanic initiatives will include flight trials and demonstrations along international routes to and from a southeast US coastal airport. Among other advantages, this allows the trials to leverage the advanced automation capabilities provided by the Advanced Technologies & Oceanic Procedures (ATOP) / Ocean 21 system.

Figure 4.4 illustrates the transition towards more distributed decision making which is fundamental to the NextGen concept and, to a lesser extent, the ATOP enhancement planned for AIRE. Significant increases in information exchange will allow flight planners an increased role in collaborating with the ANSP on capacity and flow management strategies. The flight crew has a greater role in tactical flight management tasks. For some aircraft, the flight crew may take on a more strategic flight management role, building on aircraft automation.

Transition to Distributed Information Sharing

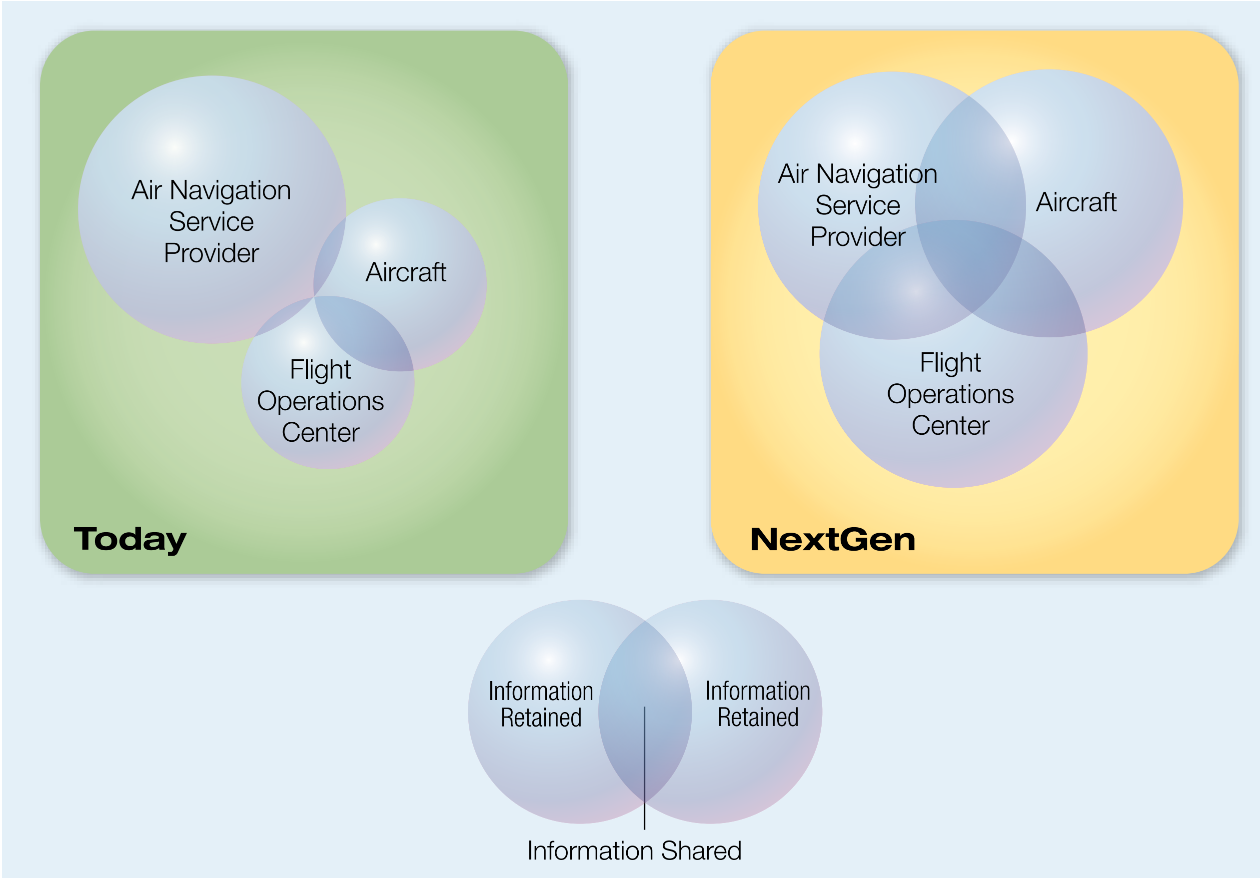


Figure 4.4

5.0

POTENTIAL ENVIRONMENTAL BENEFITS

Combined fuel savings equals lower noise and fewer emissions.

Environmental benefits will be analyzed throughout the AIRE initiative. First, to assist the definition and down-selection of proposed AIRE project trials, an initial estimate of potential benefits was established for each operational domain. This initial assessment process also established the key metrics and measurement parameters for the AIRE trials. The summary of this initial assessment is presented in Table 5.1 and described below.

Midway through the program, an Interim Assessment is planned to analyze the results of the project-based benefit analyses and modeling/ simulation completed to date.

At the end of the program, a final assessment will document: 1) the flight validated potential benefits; 2) identified road blocks to implementation; and 3) requirements for guidelines and standards for interoperability.

AIRE Technologies, Metrics, Estimates and Baseline

Domain - Demonstration Technology	Operational Metric (source)	Environmental Metric Fuel Burn, lbs	Fuel Burn Operations Segment Estimate	Baseline
Surface - ASDE-X	Taxi time (per ASDE-X)	Derived using ICAO Engine Performance Data	2%	JFK operations (w/o ASDE-X)
Oceanic - ATOP	Fuel burn calculation (per ATOP)	Derived by ATOP	4%	2004 operations
Arrival - CDA/TA	Flight Trajectories (per ET MS/PDARS)	Derived AEDT	2%	Pre CDA/ Pre TA operations

Table 5.1

Within these environmental assessments, AIRE will explore the impacts of selected new air traffic control technologies and operational improvements within the surface, arrival and oceanic domains on aircraft fuel consumption, emissions and noise. Supporting this work is a suite of analytical models which help with understanding how airspace enhancements impact the environment. The suite of analysis tools includes the following:

- The **Environmental Design Space (EDS)** provides an integrated analysis of noise and emissions for the aircraft vehicle;

- The **Aviation Environmental Design Tool (AEDT)** is an integrated tool that can generate interrelationships between noise and emissions;

- The **Aviation Environmental Portfolio Management Tool (APMT)** provides the common, transparent cost/benefit methodology to optimize choice among standards, market-based options, costs, policies and operational procedures;

As a starting point for planned flight trials and demonstrations, teams of FAA and industry subject matter experts (SME) were tasked to estimate the potential for environmental improvements in the surface, arrival and oceanic domains. The SMEs, identified in the Appendix to this Plan, reviewed previous analyses, studied the proposed new AIRE domain technologies and procedures, and estimated the potential fuel savings that could be realized in each domain.

Table 5.1 outlines each of the AIRE domains proposed demonstration technology/systems, the defined measurement source for relating the operational and corresponding environmental metrics, the fuel burn goal, and relative operational baseline (current operational capability level). New technologies and procedures could save 2% of the fuel normally consumed on the surface; 4% of the fuel normally consumed during the oceanic phase of flight; and 2% of the fuel an aircraft uses on arrival. Each pound of aviation fuel not consumed equals over 3 fewer pounds of CO2 emissions. AIRE flight trials and demonstrations scheduled for each domain will demonstrate and quantify these benefits, and validate the potential for emissions reductions.

6.0

FAA FY08 PROJECT PLANS

A suite of analytical models will explore how airspace improvements affect environment, in operational domains: surface, arrival and oceanic.

As AIRE objectives are addressed, a common set of deliverables for each of the operating domains is to include:

- **Demonstration Plan**
  Describes the flight trials and demonstrations planned for each domain.

- **Demonstration Procedure Document**
  Contains step-by-step procedures for executing demonstrations. Among other things, this ensures repeatability of the demonstration.

- **Data Collection, Reduction and Analysis Plan**
  Describes what needs to be measured, how to obtain the measurements, steps for the analysis of the measured data and what final reports are expected.

- **Data Collection, Reduction and Analysis Report**
  Contains the list of parameters collected for analysis, methodology used for data collection and reduction, and analysis of collected data.

- **Modeling and Simulation (M&S) Plan**
  Explains the domain M&S approach and provides the plan for executing that approach. At a minimum, the M&S plan will also include:

  - Past uses of particular tools and models to address credibility issues;
  - Hardware, software, and firmware required;
  - Assumptions and/or rationale for using the selected tools and models; and
  - Scalability, extensibility and integration of NAS components.

- **M&S Results and Report**
  Includes the comparison between M&S Results and collected data from demonstration for validity issues.

- **Concept of Operations**
  Describes how a proposed capability will fit into the existing infrastructure, including how it will affect other systems, staffing and logistics, at a high level. The document contains a description of what is required by way of support, including various modes of operation and time-critical parameters.

- **Demonstration Results**
  Reports the results of the domain demonstrations, assessing the validation of the goals, and recommends future action.

6.1 FY08 Surface Project

AIRE will study the efficiency impacts of expanded airport surface surveillance, data sharing, shared situation awareness, enhanced surface management applications, and surface management systems. These offer the potential for improved taxi times, fuel savings and emission reductions. 2008 AIRE Surface demonstrations will be conducted at both John F. Kennedy International Airport (JFK) and Memphis International Airport (MEM).

Overall Surface Objectives

The AIRE surface project will support the following objectives:

- Provide shared surface situational awareness;
- Develop FAA surface decision support tools;
- Enable and promote airline / airport user surface decision support tool development;
- Promote surface collaboration between NAS users and FAA;
- Develop information-sharing mechanisms between user and FAA surface decisions support systems; and
- Perform metrics collection / analysis to support the business decision on value of surface decision support.

6.1.1 JFK Surface Surveillance Implementation

The effort at JFK will capitalize upon current surface surveillance infrastructure improvements to make surface movement data available to participating airport users. AIRE will expand JFK's airport surface detection surveillance equipment-model X (ASDE-X) coverage to the commercial ramp areas, and will enable data sharing between FAA surveillance systems, commercial aircraft operators and the airport authority. The goal is to provide surface data to user-provided surface management applications and systems.

The ASDE-X system is designed to provide surveillance coverage of the airport movement area to air traffic controllers. The movement area is defined as the runways, taxiways, and other areas of the airport under air traffic control (ATC) responsibility. In order to support advanced surface traffic management (STM) applications, coverage of critical ramp areas is also required. These areas are typically under control of ramp towers that are operated by the airport, airlines or third-party operators. In some instances, these areas are not controlled at all. For STM applications to be effective, all critical surface movements need to be monitored and coordinated.

Figure 6.1 depicts the ramp areas at JFK that are candidates for the ramp coverage system. Since complete coverage of all ramp areas may not be practical, the ramp areas are prioritized to assure coverage of the most critical surface movements.

The ramp surveillance system coverage priority is as follows:

JFK Ramp Areas

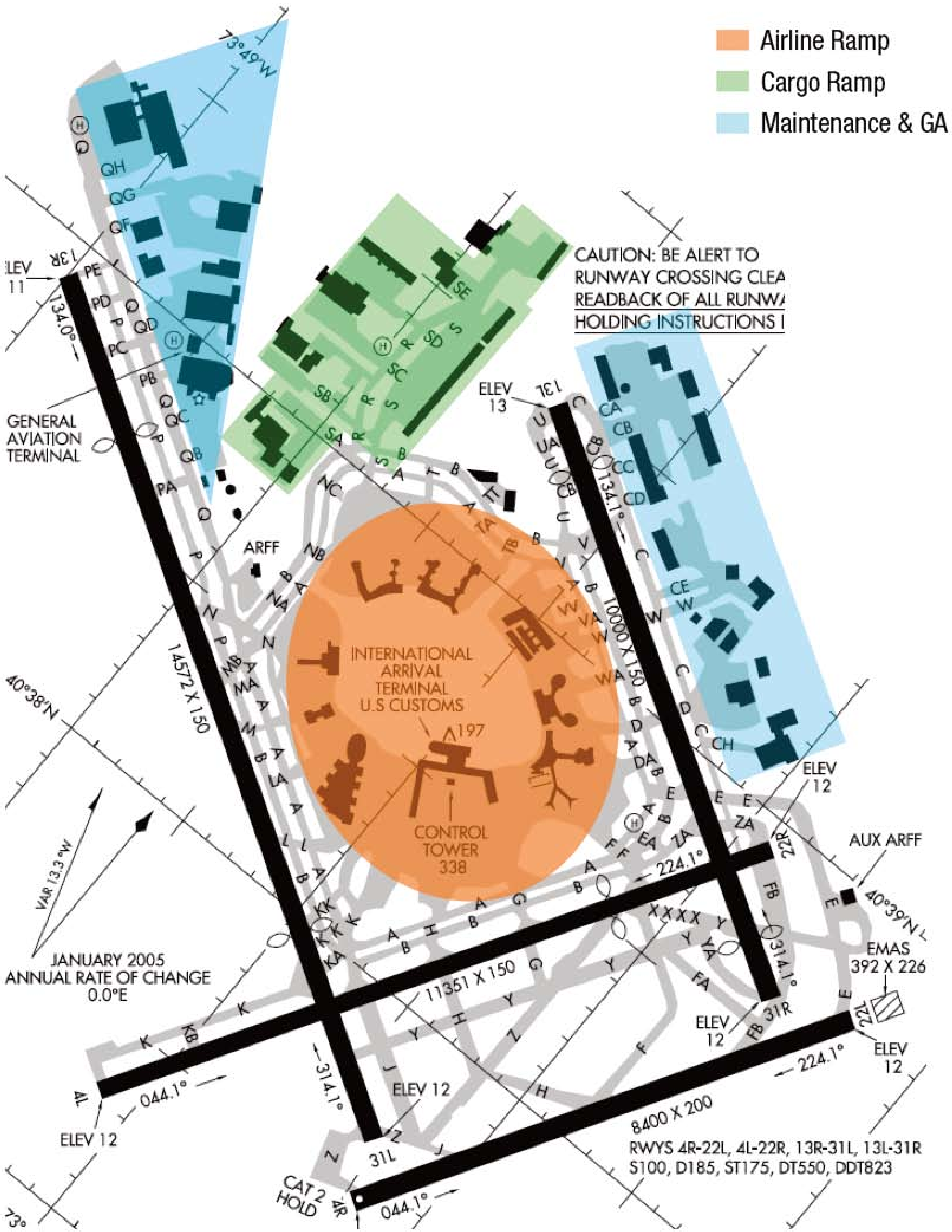


Figure 6.1

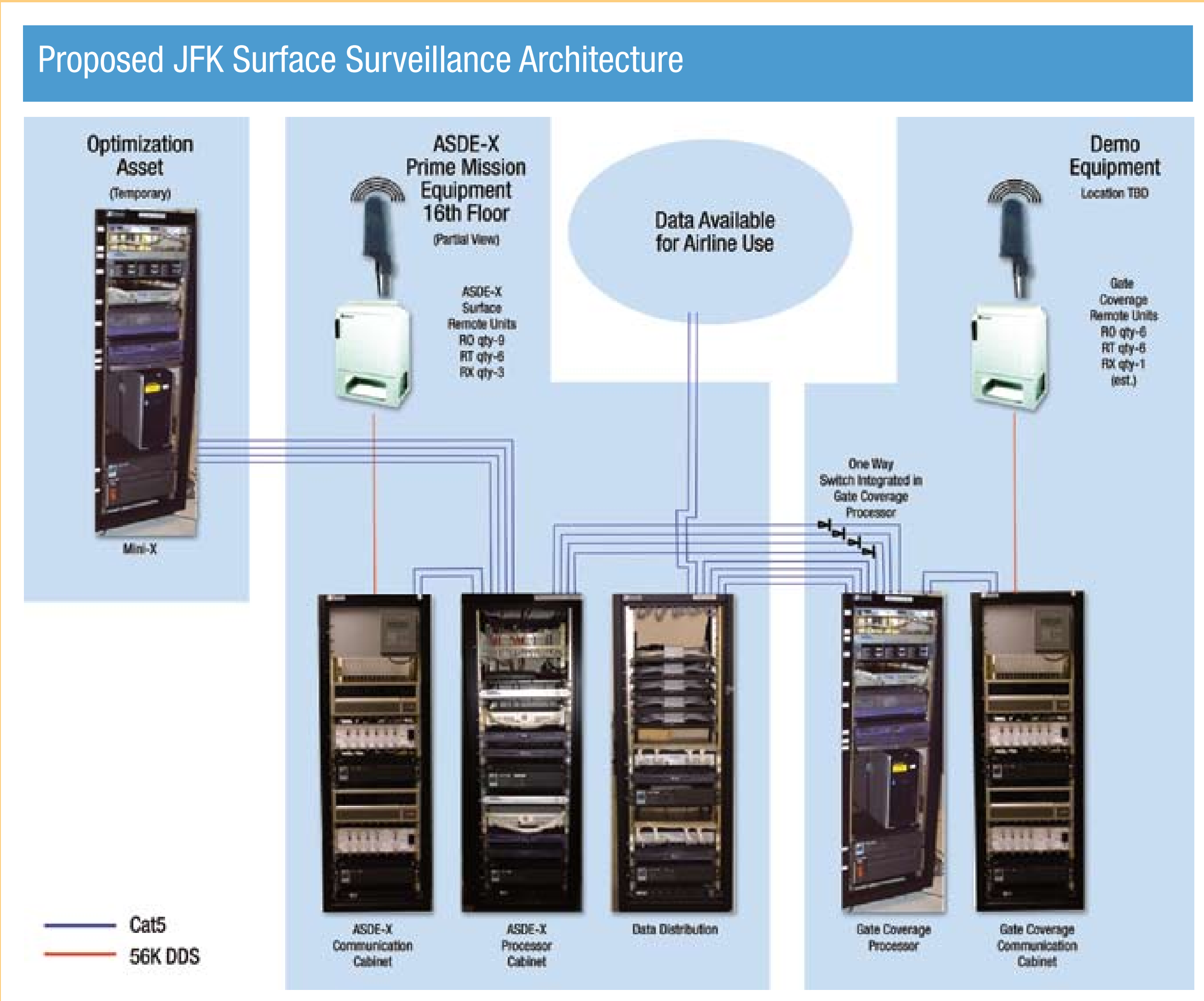


Figure 6.2

Priority 1 – Passenger Airline Ramp

The red area in the center of the diagram represents the passenger airline ramp area that is controlled by six (6) ramp towers:

- Terminal 1 – Contract (PANYNJ)
- Terminals 2, 3 – Delta Airlines
- Terminal 4 – IAT (International)
- Terminal 5, 6 – JetBlue
- Terminal 7 – United Airlines
- Terminal 8, 9 – American Airlines

Note: Terminal 5 is under renovation and will reopen in late 2008.

Priority 2 – Cargo Airline Ramp

The green area represents the cargo airline ramp area. There are no ramp towers controlling this ramp. Surface surveillance data will be available for cargo airline operators.

Priority 3 – Maintenance and General Aviation Ramps

The blue areas represent the airline maintenance (northeast) and general aviation (northwest) ramp areas. These areas are not controlled by ramp towers. Coverage of the transition areas adjacent to the movement area will provide the required surveillance for surface traffic management applications.

Since the ASDE-X system is critical to runway safety and ATC use, it is vital that supplemental ramp coverage does not interfere with ASDE-X operations. The ramp coverage system is designed to receive surface surveillance coverage from the ASDE-X system as well as the ramp coverage system. However, the ASDE-X and associated ATC displays will not receive any of the ramp coverage. The ramp surveillance system will have independent processing capability, further eliminating interference with the ASDE-X used by ATC. Figure 6.2 is a system architecture diagram that depicts the current proposed installation at JFK.

JFK New York Airport Objectives

- Establish surface surveillance at JFK New York
  - Accelerate ASDE-X installation
  - Provide surface surveillance to airport users
    - Install ASDE-X data distribution system
    - Augment ASDE-X to provide ramp area coverage

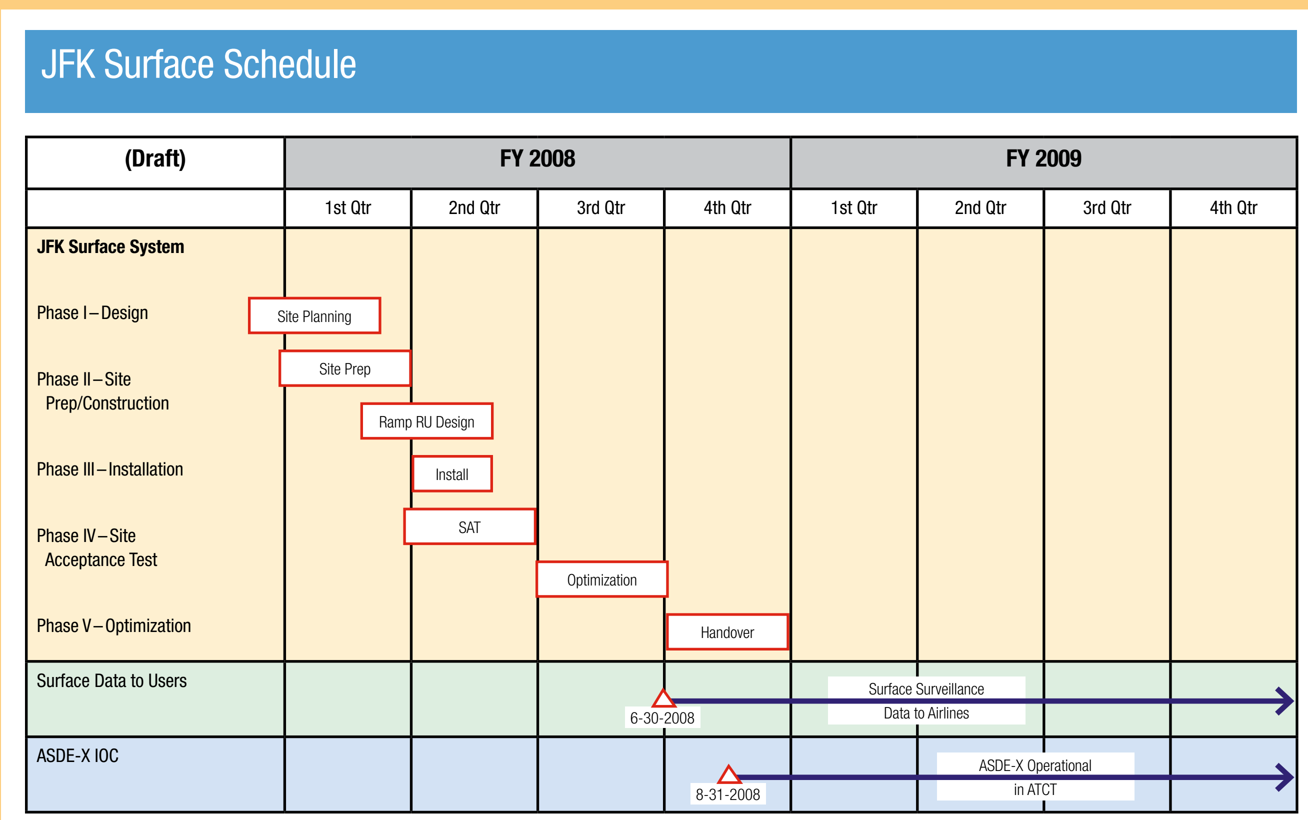


Figure 6.3

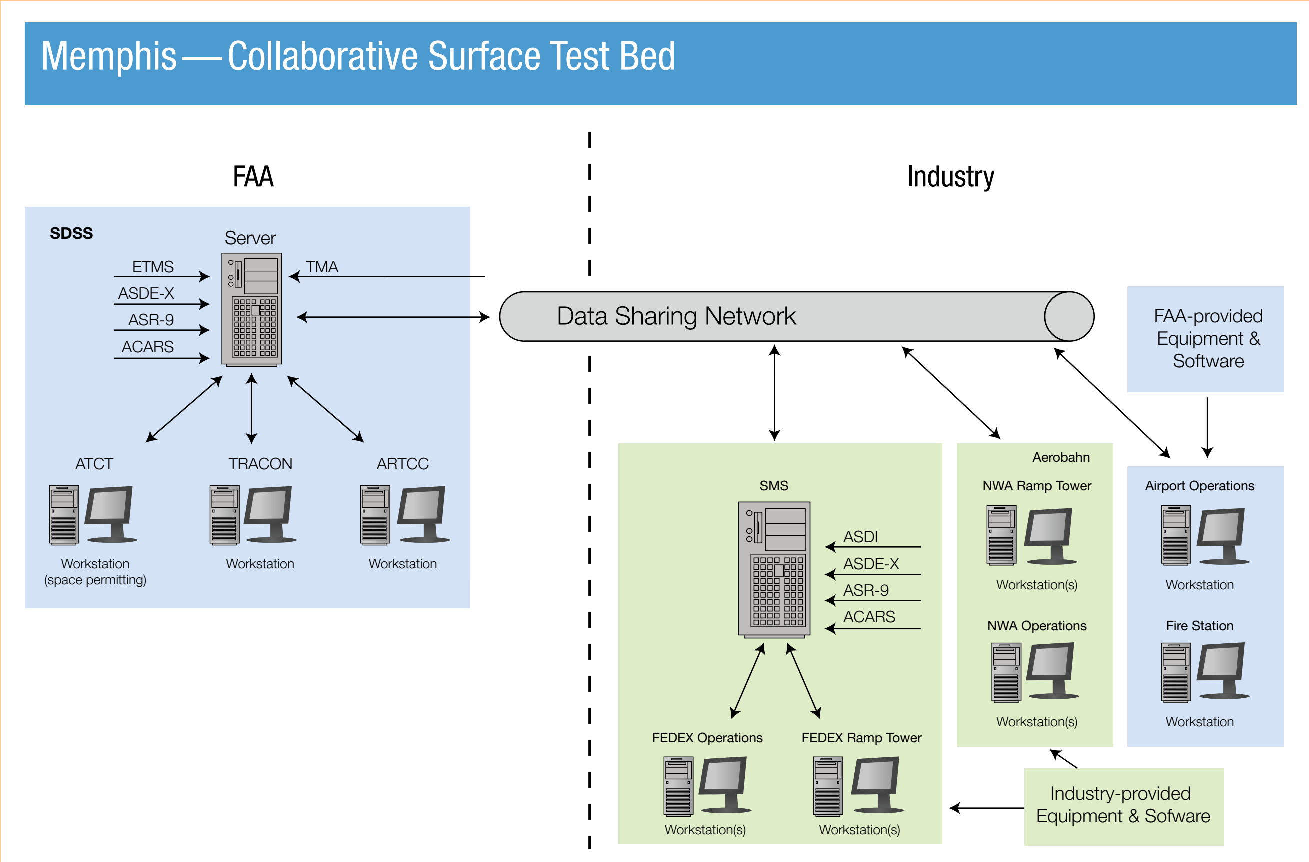


Figure 6.4

6.1.2 Memphis Surface Surveillance Implementation

At Memphis International Airport (MEM), the AIRE Surface Domain initiative will expand the scope of a legacy MEM demonstration to create a fully-collaborative system linking multiple carriers, the airport authority and ATC. The AIRE project will install a surface traffic management system called the Surface Decision Support System (SDSS). SDSS is the National Aeronautics and Space Administration (NASA) surface management system enhanced by development work resulting from the Louisville International Airport (SDF) project, in partnership with UPS Airlines.

SDSS will also be configured as an open architecture, prototype system to allow communication and collaboration with third-party STM systems operated by airlines, ramp tower operators, and airport operators. Partnerships will be established to promote system development and to maintain compatibility with the SDSS test bed.

The Memphis test bed is intended to serve as a requirements development platform to support future FAA STM acquisitions. Once the test bed is operational, new capabilities can be tested, developed, and transitioned for acquisition

SDSS can support more efficient movement of aircraft on and off runways and to and from arrival and departure gates. Supported by advanced decision support tools, SDSS can minimize unnecessary engine ground run time, and conserve

Typical SDSS User interface Display

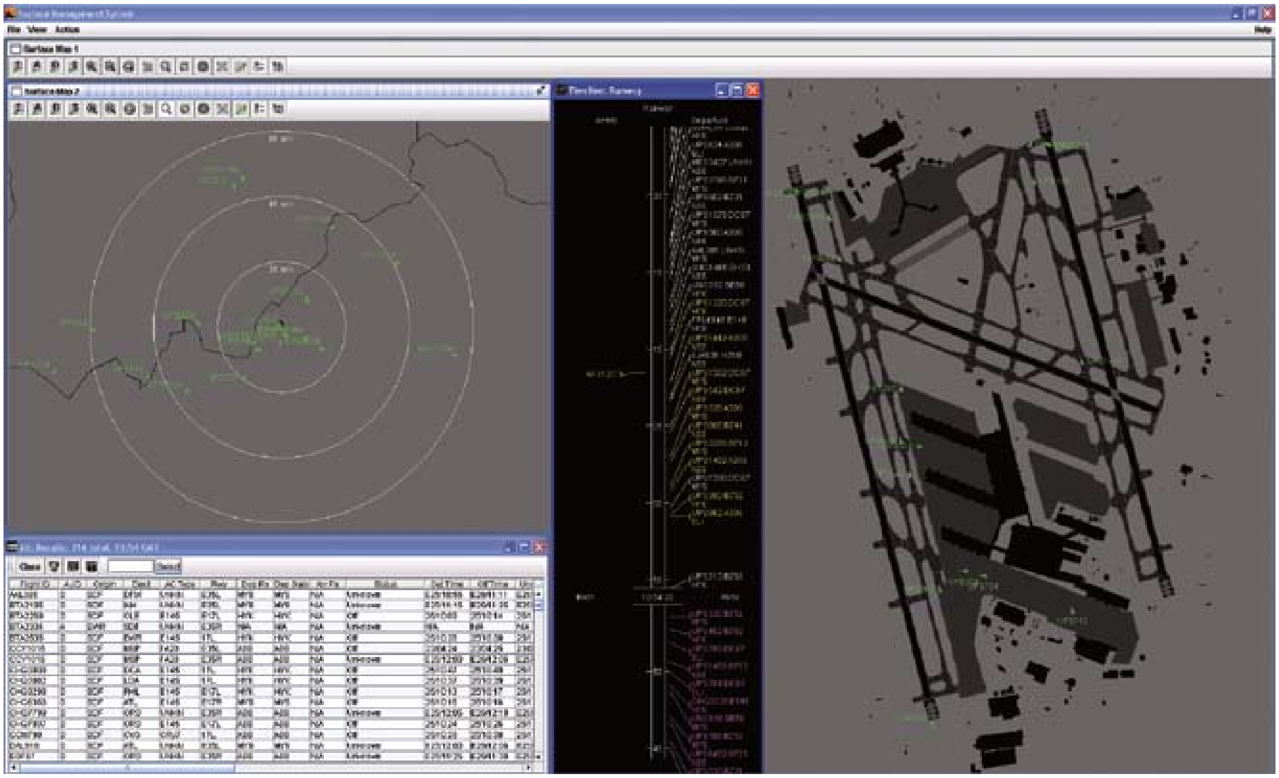


Figure 6.5

aircraft stop and starts during taxi. For cold weather operations, more efficient aircraft departure management can reduce the need for repeated aircraft de-icing, lowering de-icing fluid use. An SDSS user interface is illustrated in Figure 6.5.

Memphis Airport Objectives

- Establish a fully-collaborative surface environment test bed at Memphis to support NextGen surface development activity
  - Expand existing Memphis (FedEx) demonstration
    - Establish ATC / ATM participation
      - New architecture
      - Equipment for ATC facilities
      - New software baseline
  - Expand industry participation to Northwest Airlines and airport operations
- Perform metrics collection / analysis
- Develop requirements, operational concepts, and business cases to support future acquisition

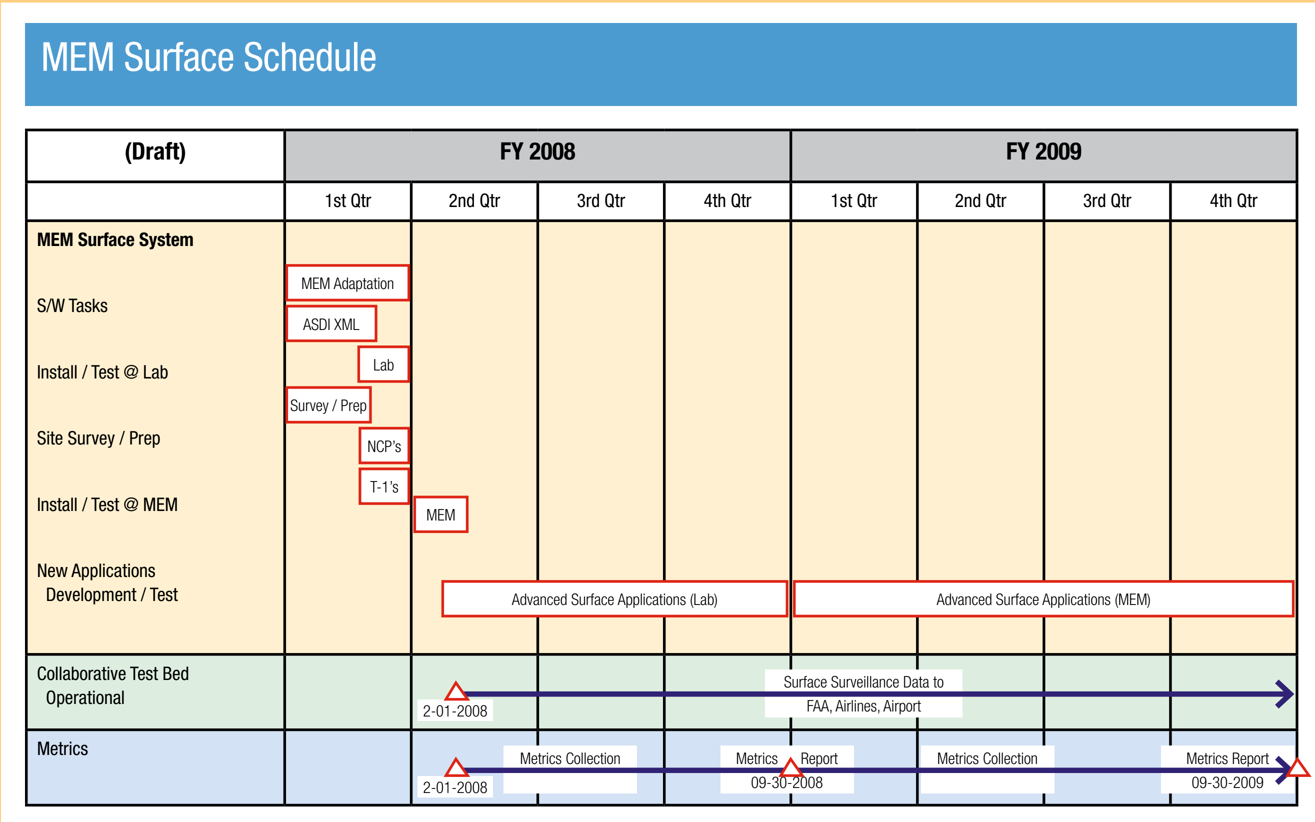


Figure 6.6

6.1.3 Surface Benefits Analysis

The AIRE surface demonstrations will focus upon efficiency improvements, operational advantages, and the associated environmental benefits of shared surface situational awareness, common decision support tools, and collaborative decision-making. Recorded ASDE-X data, correlated to NAS flight plan data and weather data, is the preferred data source for AIRE surface analyses to measure inbound and outbound taxi times, number and length of stop times, and delays on the runway. The Aviation Environmental Design Tool (AEDT) will be applied to compute fuel use, noise, and emissions. The approach to metrics for the surface domain is presented in Figure 6.7.

6.1.4 Surface Project Milestones

- Sep 2007: AIRE Kick-off Meeting
- Mar 2008: Initial SDSS Concept of Operations
- Apr 2008: MEM Collaborative Test Bed Operational/Commence Field Feasibility Study
- Jun 2008: JFK Ramp Surveillance data available
- Jun 2008: Begin Concept Requirements Definition Process
- Sep 2008: Complete laboratory development of initial set of advanced applications
- Oct 2009: Initiate demonstration of advanced surface applications

6.1.5 Surface Project Deliverables

- Dec 2007: Demonstration Plan
- Jan 2008: Demonstration Procedure Document
- Sep 2008: Data Collection, Reduction and Analysis Report
- Mar 2008: Concept of Operations
- Sep 2009: Data Collection, Reduction and Analysis Report
- Sep 2009: Demonstration Report

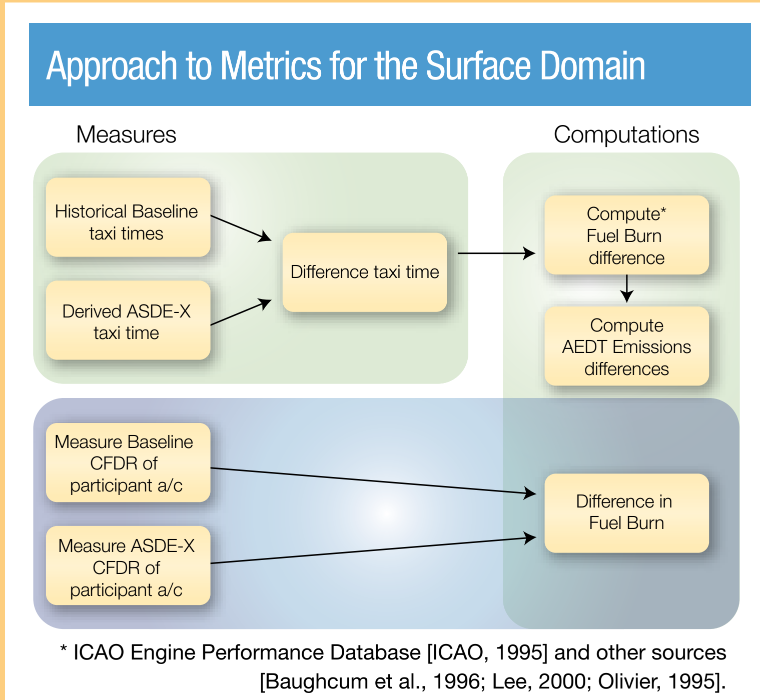


Figure 6.7

6.2 FY08 Arrivals Project

In FY'08 the AIRE arrivals project is evaluating the operational feasibility, and quantifying the potential benefits, of the two advanced arrival concepts described in Section 4.2 above. Both concepts enable arriving aircraft to achieve low-thrust descents that reduce their fuel consumption and lower their emissions and noise footprints.

A second Continuous Descent Arrivals (CDA) procedure will be added to ongoing trials at Atlanta (ATL) International Airport to allow participation for the Atlantic inbound traffic arriving from the northeast. In addition, a new Standard Terminal Arrival Route (STAR) will be developed for transatlantic flight trials of CDA and Tailored Arrival (TA) procedures into Miami (MIA) International Airport.

6.2.1 Continuous Descent Arrivals

The AIRE project will conduct CDA demonstrations at ATL and MIA to assess operational impacts, aircraft and procedure design capabilities, and to understand efficiencies for fuel savings and emissions reductions with a focus on transatlantic flights. The CDA objectives are:

- Assess key metrics relating to the implementation of CDAs;
- Establish pre-demonstration baseline to measure key metrics in current operational environment;
- Define and chart optimal vertical paths for aircraft and airspace efficiencies;
- Determine expected level of benefit via modeling and simulation;
- Establish data collection and analysis plan; and

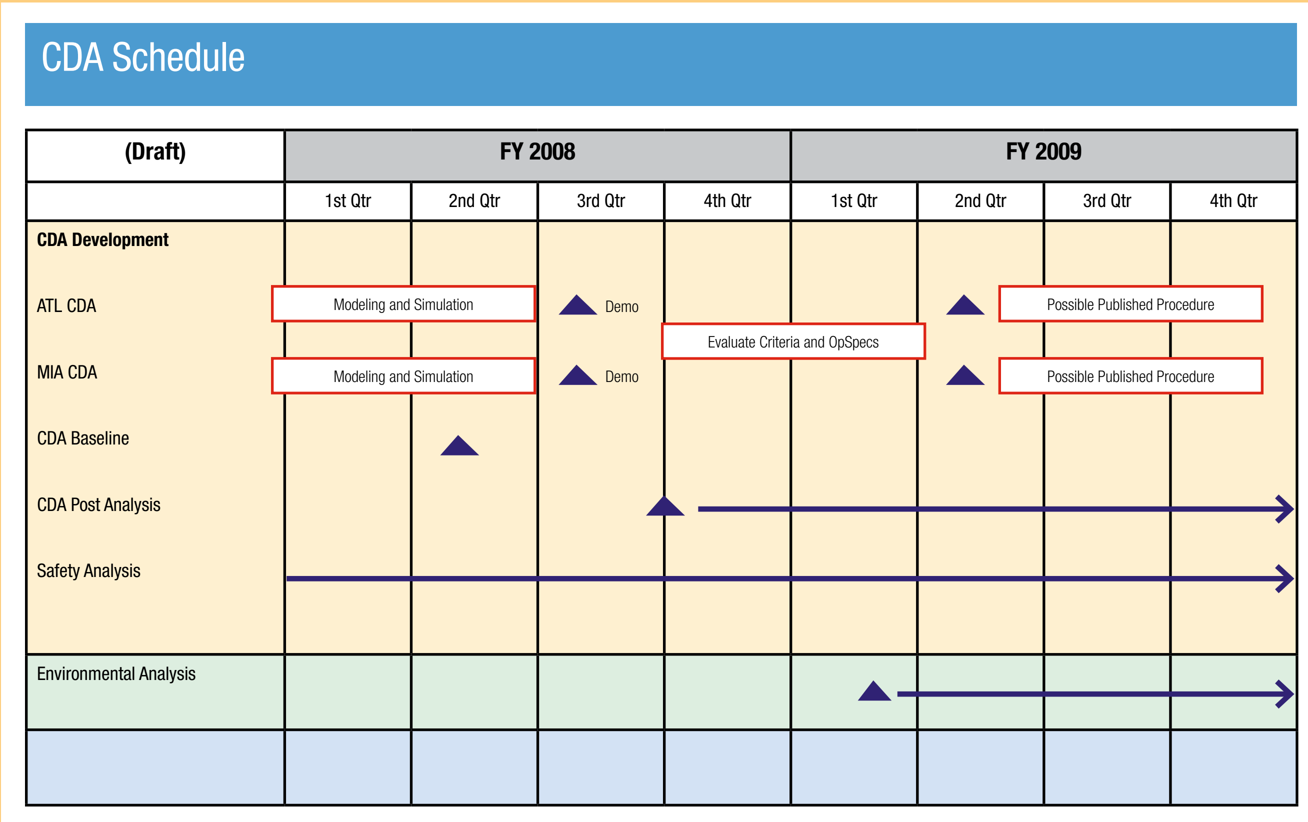


Figure 6.8

- Perform post-demonstration operational evaluation to validate savings of emissions, fuel, time and noise.

In addition AIRE will develop and refine tools, knowledge and best practices relating to CDA procedure integration into the NAS and CDA usage during higher traffic conditions:

- Provide and refine procedure development expertise and capture lessons learned;

- Assess airspace and traffic flow impact of design and implementation of CDA procedures;

- Enhance controller familiarity with CDA operations through human-in-the-loop simulations; and

- Develop a deeper understanding of the key factors affecting aircraft vertical performance.

The following CDA project plan outlines a structured approach and key activities to assist in the development and implementation of CDA procedures at Atlanta (ATL) and Miami (MIA) airports in support of AIRE. This plan serves as a management tool to assess progress and ensure schedule integrity in meeting the goal demonstration date of May 2008. A secondary benefit is its utility as a checklist of activities. These activities are based on the Guidelines for Implementing Terminal RNAV Procedures found in Federal Aviation Administration (FAA) Order 7100.9. The ATL and MIA CDAs will be modifications of existing RNAV Standard Terminal Arrivals (STARs). Consequently, not all items in the project plan checklist will be required.

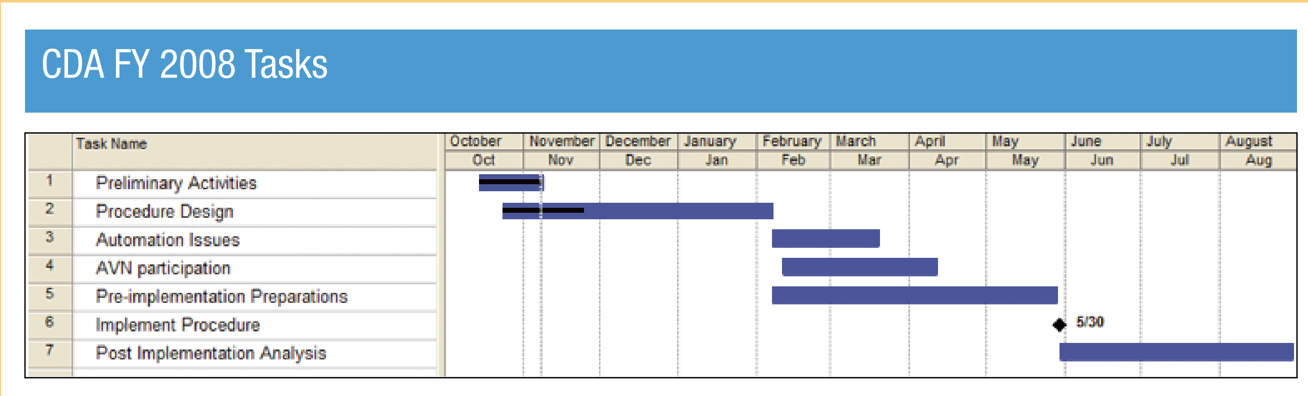


Figure 6.9

However, in order to ensure that nothing is overlooked, all potential activities are included in the plan. Figure 6.8 represents a high level overview plan. Figure 6.9 focuses on FY 2008 tasks.

CDA Milestones

- Sep 2007: FAA/Industry AIRE CDA Kick-off Meeting – **Completed**
- Oct 2007: Establish ATL and MIA CDA working groups – **Completed**
- Feb 2008: Finalized CDA procedure designs
- Mar 2008: Human-in-the-Loop Simulations
- May 2008: Baseline Airspace Evaluation Complete
- May 2008: Begin CDA Demonstration Flights

CDA Deliverables

- Aug 2008: Benefits Assessment Report

6.2.2 Tailored Arrivals

The San Francisco (SFO) Ocean Tailored Arrival (OTA) effort will be continued for risk mitigation and cost reduction. Formal procedures for cross-center arrival clearances will be developed and validated with multiple airline TA flights into SFO. Improved weather information uplink will be developed to harmonize the optimized descent profile computed by the ground automation and the aircraft's FMC.

Tailored Arrival Objectives

- Demonstrate reduced fuel-burn, noise and emissions while maintaining runway capacity
  - Establish baseline to measure fuel consumption and emissions for current arrivals
  - Define performance metric for analysis
  - Define data collection methodology
  - Establish data reduction/comparison methodology
  - Analyze fuel burn and emissions improvement (i.e., potential benefits) for optimized arrival flight profiles
- Demonstrate reduced voice communications along with associated pilot and controller workload

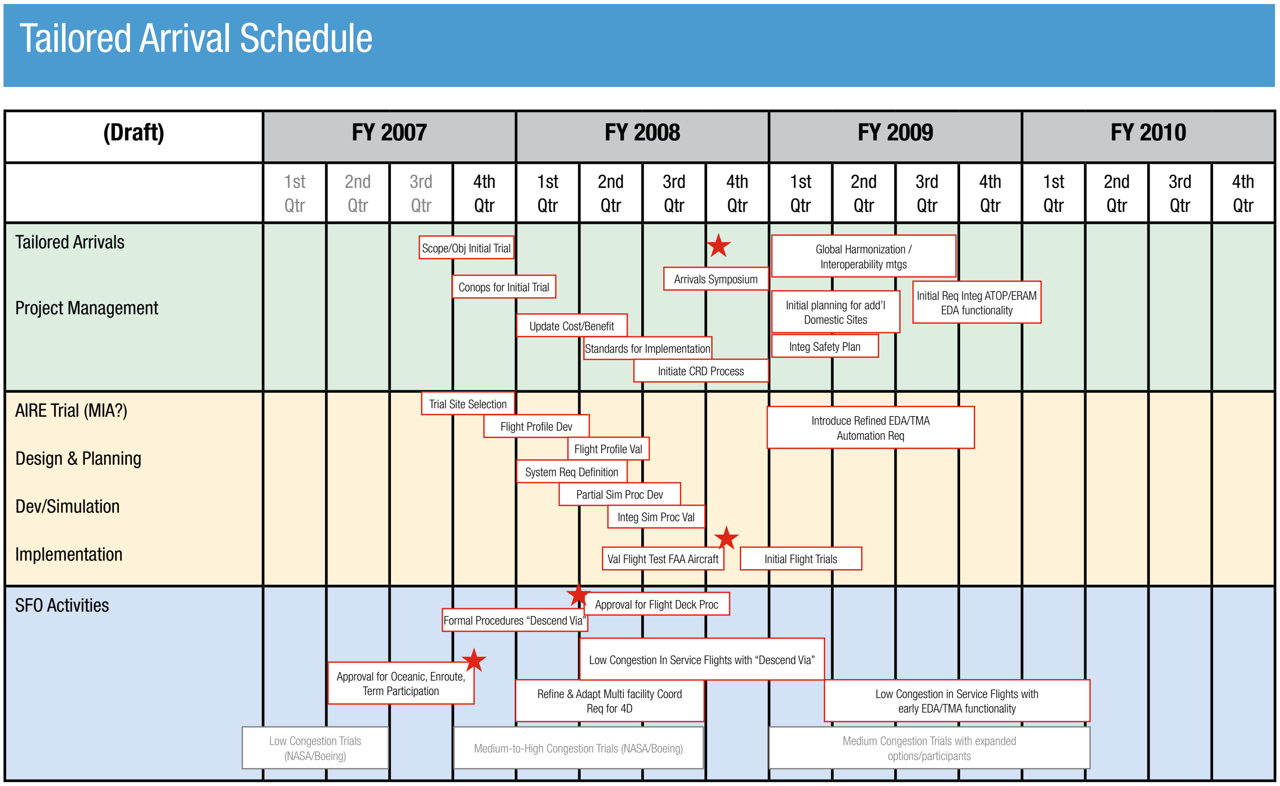


Figure 6.10

- Establish baseline to measure current average number of voice communications, pilot and controller arrival activities
- Define performance metric for analysis
- Define data collection methodology
- Establish data reduction/comparison methodology
- Determine reduction in voice communication and pilot / controller workload

• Develop and evaluate new standards, procedures, and best practices that lead to global inoperability:

- Use new decision support tool to define requirements that would ultimately be integrated into the Traffic Management Advisor (TMA)
- Use human-in-the-loop simulations to evaluate concept feasibility
- Evaluate new operational procedures and clearance phraseology

• Establish fast-time modeling and simulation capability:

- Analyze the current traffic
- Evaluate concept benefits

- Validate result(s) with collected data from demonstration flight trials

Tailored Arrival Milestones

- Sep 2007: AIRE Kick-off meeting
- Oct 2007: Select airports for demo
- Mar 2008: Procedures developed and validated for initial Tailored Arrivals clearance delivery and execution across multiple ATC facilities and control sectors (SFO OTA)
- Mar 2008: Procedures for weather uplinks (SFO OTA)
- Sep 2008: Begin Tailored Arrivals into MIA

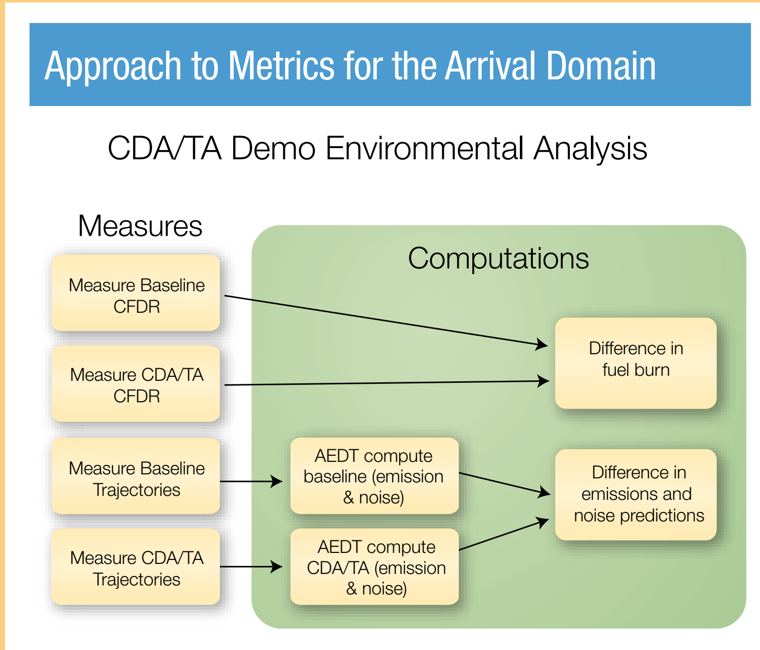


Figure 6.11

Tailored Arrivals Deliverables

- Dec 2007: SFO OTA Technical Implementation Plan
- Mar 2008: SFO OTA Validated cross-center procedures
- Mar 2008: SFO OTA Recommendations for follow-on TA work based on lessons learned
- Jan 2008: Demonstration Plan
- Feb 2008: Demonstration Procedure Document
- Mar 2008: Data Collection, Reduction and Analysis Plan
- Dec 2008: Data Collection, Reduction and Analysis Report
- Mar 2008: Modeling and Simulation (M&S) Plan
- Jun 2008: M&S Results and Report
- Apr 2008: Concept of Operations for Congested Airspace
- Dec 2008: Demonstration Results

6.2.3 Arrivals Benefits Analysis

AIRE arrival demonstrations will focus upon efficiency improvements, operational advantages, and the associated environmental benefits of CDA and TA optimized vertical profiles relative to established arrival baselines. Cockpit Flight Data Recorder (CFDR) information is the preferred data source for AIRE arrival analyses. The Aviation Environmental Design Tool (AEDT) will be applied to compute fuel use, noise, and emissions. The approach to metrics for the arrival domain is presented in Figure 6.11.

6.3 Oceanic Project

For the AIRE Program, U.S. and European ANSP and industry partners will demonstrate collaborative en route trajectory optimization in the oceanic environment using a manual optimization process with assistance from automated profile optimization tools as a first step towards a functional and automated process for Oceanic Trajectory Management.

The collaborative oceanic trajectory optimization demonstration phase of AIRE will make use of a dedicated Oceanic Coordinator position co-located with the New York Oceanic operation. For the purposes of the demonstration, the role of the Oceanic Coordinator will be to suggest amendments to the 4D profile of participating aircraft that will optimize the flight's fuel consumption. This manual function will be assisted by offline tools that can assess proposed speed, track and altitude changes using updated wind information. The conflict probe function of the ATOP system will then be used to ensure that proposed profile changes are conflict free. If recommended changes are acceptable to the flight crew, the airline's operations center and the responsible air traffic controller, the flight crew will then downlink the proposed change as a request for revised clearance. The responsible air traffic controller will then respond to the clearance request using existing procedures.

This manual process used in the AIRE demonstration will provide valuable information for the longer term, NextGen 4D Oceanic Trajectory Management program. Collaborative oceanic trajectory optimization will demonstrate the potential for fuel savings in the oceanic domain and the associated environmental benefits by making only minor modifications to a flight's 4D profile. In addition, the demonstration will support development of automated oceanic trajectory optimization systems.

6.3.1 Oceanic Objectives

Demonstrate fuel savings and emissions reductions in transatlantic flights through oceanic trajectory collaboration and optimization, to include:

- Establish baseline to measure fuel consumption and emissions for current transatlantic flights in order to demonstrate fuel savings and emissions reductions

- Investigate the use of existing oceanic systems and oceanic trajectory optimization tools to improve fuel savings and reduce emissions

- Improve current oceanic ATC procedures to reduce emissions

- Validate new procedures and tools in a controlled environment

- Establish partnerships with airlines and other government agencies and industry partners to conduct AIRE demonstration

- Analyze AIRE demonstration performance metrics

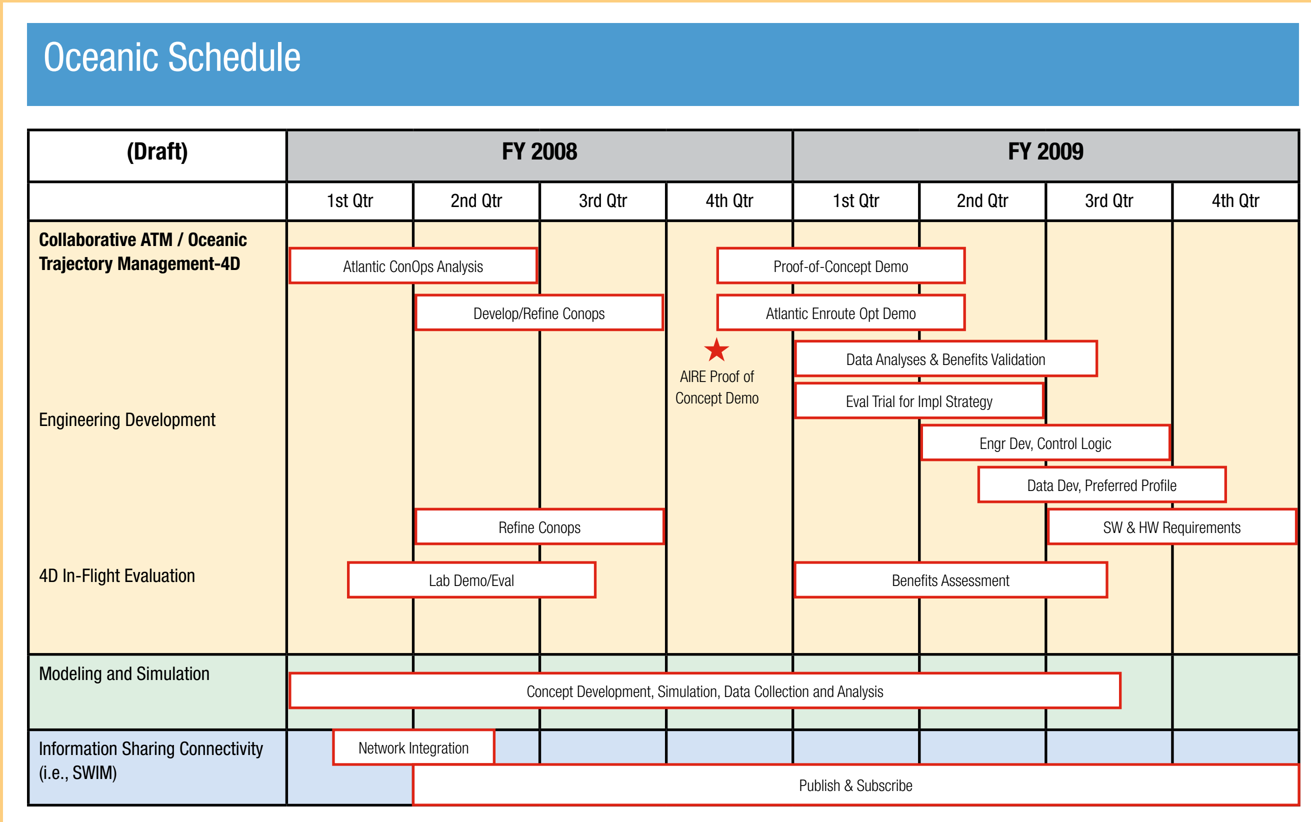


Figure 6.12

6.3.2 Oceanic Schedule

The Oceanic schedule is shown in Figure 6.12.

6.3.3 Oceanic Project Milestones

- Sep 2007: AIRE Kick-off meeting
- Nov 2007: Establishing AIRE-Oceanic partnership (airlines, airports, centers, NASA, vendors)
- Nov 2007: AIRE-Oceanic Government/ Industry Partnership Kick-off meeting
- Feb 2008: Information sharing connectivity
- Apr 2008: Refined Concept of Operations
- Jun 2008: Lab demonstration and evaluation
- Jul 2008: Completion of Memorandums of Agreement (MOA)
- Sep 2008: Begin transatlantic flight demonstration

6.3.4 Oceanic Project Deliverables

- Apr 1, 2008 (draft), Aug 1, 2008 (Final): Concept of Operations Document
- Apr 7, 2008 (draft), Apr 30, 2008 (Final): Modeling and Simulation (M&S) Plan
- May 1, 2008 (draft), May 30, 2008 (Final): Demonstration Plan Document
- May 23, 2008 (draft), Jun 13, 2008 (Final): Demonstration Procedures Document

Approach to Metrics for the Oceanic Domain

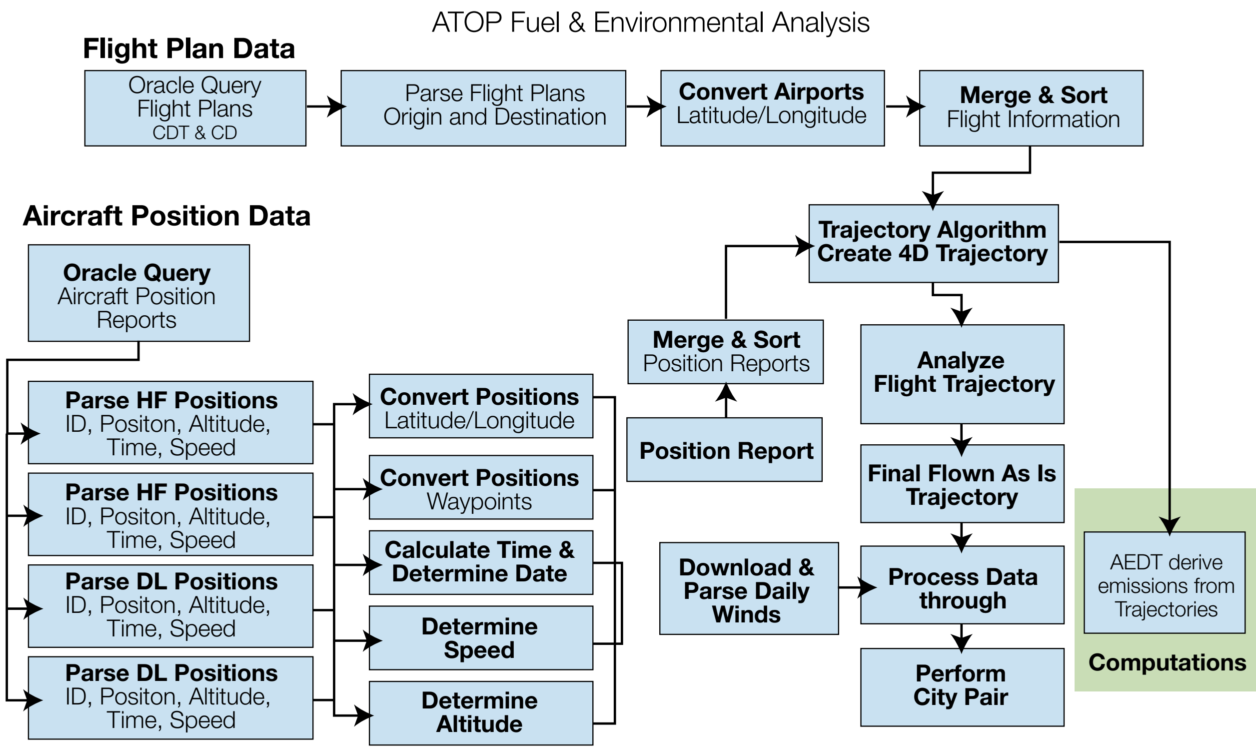


Figure 6.13

- Jul 1, 2008 (draft), Jul 31, 2008 (Final): M&S Results and Report

- Oct 17, 2008 (FY09) (draft), Nov 14, 2008 (Final): Demonstration Report (Quick look)

- Apr 1, 2009 (FY09) (draft), Apr 30, 2009: Data Collection, Reduction and Analysis Report

- May 15, 2009 (FY09) (draft), Jun 12, 2009 (Final): Final Report

6.3.5 Oceanic Benefits Analysis

AIRE will explore efficiencies achievable with collaborative oceanic trajectory optimization enhancements using ATOP. Program demonstrations will investigate operational enhancements and the associated environmental benefits achievable from a more dynamic and pro-active application of the ATOP automation. AIRE trials will measure en route performance and identify changes in cruise efficiency compared to the reference oceanic baseline. Additional baselining is necessary to support these studies.

The methodology for estimating fuel use will be identical to the procedures developed for the ATOP system analysis. Emission metrics will be derived from the Aviation Environmental Design Tool (AEDT) computer program developed by the FAA's Office of Environment and Energy (AEE). The approach to metrics for the oceanic domain is presented in Figure 6.13.

7.0

BUDGET

AIRE project resources.

As shown in Figure 7.1 below, AIRE FY08 project resources total $8.85M.* Work descriptions and more detailed budget information are available in each of the domain project plans.

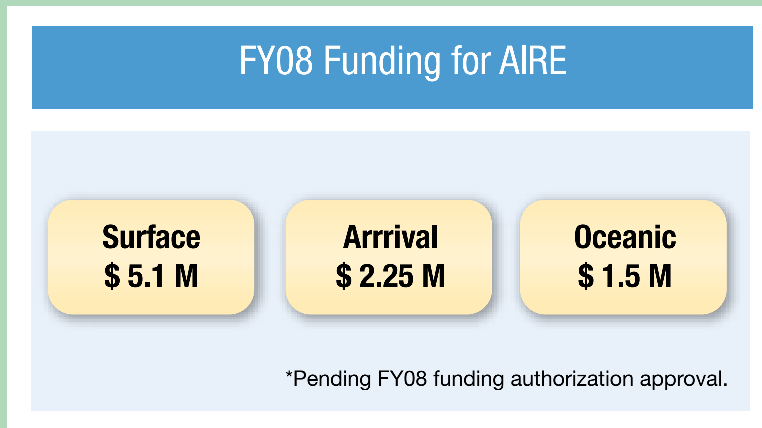


Figure 7.1

8.0

RISK

AIRE domain plans include risk mitigation strategies.

Risk management will be applied to all flight trials and demonstrations to identify and mitigate risks associated with achieving AIRE objectives. Each domain will implement risk management processes to: (1) identify and assess risk areas; (2) develop and execute risk mitigation or elimination strategies; (3) track and evaluate mitigation efforts; and (4) continue mitigation activity until risk is eliminated or its consequences reduced to acceptable levels.

9.0

APPENDIX

AIRE Domain Subject Matter Experts

AIRE Program Office		
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	Bill Fromme	CALIBRE Systems

Oceanic Domain	Technical Experts	Affiliation
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	Durham, Michael H.	Boeing
	Sharma, Vivek	Boeing
	Karakis, Tamara	CSSI
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	Chamness, Kevin	FAA
	Draper, Julie	FAA
	Gulding, John	FAA
	Guy, Rebecca	FAA
	Holsclaw, Curtis	FAA
	Liu, Sandy	FAA
	Locke, Maryalice	FAA
	Maurice, Lourdes	FAA
	Morales, Angel	FAA
	Ngo, Thien	FAA
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	Jones, Kenneth M.	NASA
	Senzig, David	VOLPE Center

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	Gulding, John	FAA
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	Locke, Maryalice	FAA
	Maurice, Lourdes	FAA
	Morales, Angel	FAA
	Prevost, Tom	FAA
	Parra, Art	FedEx
	Vail, Steve	FedEx
	Wall, Roger	FedEx
	Senzig, David	VOLPE Center

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	Buntin, Charles	FAA
	Gulding, John	FAA
	Locke, Maryalice	FAA
	Maurice, Lourdes	FAA
	Liu, Sandy	FAA
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	Durham, Michael H.	Boeing
	Frostbutter, David A.	APL, Johns Hopkins U
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